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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/894,987	06/27/2001	Mark Ghinovker	KLA1P018	3806

22434 7590 07/02/2004
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EXAMINER

KIBLER, VIRGINIA M

ART UNIT	PAPER NUMBER
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2623

DATE MAILED: 07/02/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/894,987

Applicant(s)

GHINOVKER ET AL.

Examiner

Virginia M Kibler

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-35 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-35 is/are rejected.
- 7) ☒ Claim(s) 10 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 June 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>5-8</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Drawings

1. The drawings are objected to under 37 CFR 1.83(a) because they fail to show elements 174 and 176 in Figure 11 as described in the specification on page 33 and elements 198A and B in Figure 12 as described in the specification on page 36. Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing. MPEP § 608.02(d). Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled “Replacement Sheet” in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

2. The disclosure is objected to because of the following informalities: “measurement..” should be changed to “measurement.” on page 12, line 19; “approximately1to” should be changed to “approximately 1 to” on page 16, line 32; “noted , however,” should be changed to “noted, however,” on page 17, line 10; “Fig. 1” should be changed to “Fig. 2” on page 18, line 25; “um” should be changed to “μm” on page 21, lines 11 and 14; “Lithography Process Control” should be changed to “Lithography Process Control” on page 22, line 22; “1322B&C” should be changed to “132B&C” on page 31, line 9; “1322F&G” should be changed to “132F&G” on page 31, line 17; “132H” should be changed to “132F” on page 31, line 27; “132F” should be changed to “132G” on page 31, line 28; “132G” should be changed to “132H” on page 31, line 28; “perimeter .” should be changed to “perimeter.” on page 34, line 12; “136” should be changed to “196” on page 35, line 13; “192H” should be changed to “192F” on page 35, line 26; “192F” should be changed to “192G” on page 35, line 27; and “192G” should be changed to “192H” on page 35, line 27.

Appropriate correction is required.

Claim Objections

3. Claim 10 is objected to because of the following informalities: “is configured” should be changed to “are configured” in line 2. Appropriate correction is required.

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Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 1, 2, 4, 5, 8, 10, 12, 20, 21, 24, 25, and 30-32 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites the limitation "the relative shift" in line 1.

Claim 2 recites the limitation "the image" in line 1.

Claim 4 recites the limitation "the perimeter" in line 2.

Claim 5 recites the limitations "the optical perimeter," "the field of view," and "the metrology tool" in line 2.

Claim 8 recites the limitation "the impact" in line 2.

Claim 10 recites the limitation "the metrology" in line 3.

Claim 12 recites the limitation "the wafer" in line 2.

Claim 20 recites the limitations "the relative shift," "the perimeter," "the first working group," and "the second working group" in lines 1, 19, and 22-23.

Claim 21 recites the limitations "the optical perimeter" and "the field of view" in line 2.

Claim 24 recites the limitation "the impact" in line 2.

Claim 25 recites the limitation "the metrology" in line 3.

Claims 30 and 31 recite the limitation "the relative shift" in line 1.

Claim 32 recites the limitation "the 2D images" in line 2.

There are insufficient antecedent basis for these limitations in the claims.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1-4, 7, 9, 11, 12, 15-20, 23, 26, and 27 are rejected under 35 U.S.C. 102(e) as being anticipated by Bareket (6,462,818).

The applied reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C.

102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention “by another,” or by an appropriate showing under 37 CFR 1.131.

Regarding claim 1, Bareket (6,462,818) discloses at least one test pattern 20 for determining the relative shift between a first and a second layer of the substrate in a first direction, along the x-axis (Col. 3, lines 49-67), the test pattern having a first set of working zones 40B and 40C (Figure 2) and a second set of working zones 50B and 50C (Figure 2), the first set being disposed on a first layer of the substrate and having at least two working zones, 40B and 40C, diagonally opposed and spatially offset relative to one another, the second set

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being disposed on a second layer of the substrate and having at least two working zones, 50B and 50C, diagonally opposed and spatially offset relative to one another (Col. 4, lines 12-34).

Regarding claim 2, Bareket (6,462,818) discloses an image of the test pattern is captured via an imaging tool (Figure 3) and an analysis algorithm is used to calculate the relative displacement of the working zones from the captured images (Col. 5, lines 15-35; Col. 6, lines 21-38; Col. 7, lines 9-67, Col. 8, lines 1-49).

Regarding claim 3, Bareket (6,462,818) discloses the first set of working zones, 40B and 40C, is angled relative to the second set of working zones, 50B and 50C (Figure 2).

Regarding claim 4, Bareket (6,462,818) discloses the working zones are positioned within the perimeter of the mark (Figure 2).

Regarding claim 7, Bareket (6,462,818) discloses the working zones are spatially separated from one another so that they do not overlap portions of an adjacent working zone (Figure 2).

Regarding claim 9, Bareket (6,462,818) discloses including a periodic structure positioned within each of the working zones, each of the periodic structures including a plurality of coarsely segmented elements (Figure 2).

Regarding claim 11, Bareket (6,462,818) discloses the coarsely segmented elements are parallel lines (Figure 2).

Regarding claim 12, Bareket (6,462,818) discloses the relative shift between the first and second layers of the wafer is determined by comparing the relative positions of periodic structures on different layers (Col. 2, lines 33-55).

Regarding claim 15, Bareket (6,462,818) discloses including a second test pattern 30 for determining the relative shift between a first and second layer of the substrate in a second direction (Figure 2; Col. 3, lines 49-67).

Regarding claim 16, Bareket (6,462,818) discloses each test pattern, 20 and 30, produces an "X" configured mark that are positioned orthogonal to each other, thereby the second test pattern 30 is orthogonal to the first test pattern (Figure 2).

Regarding claim 17, Bareket (6,462,818) discloses the first direction corresponds to the X-direction and the second direction corresponds to the Y-direction (Col. 3, lines 49-67).

Regarding claim 18, Bareket (6,462,818) discloses including a third test pattern 40A and 50A and a fourth test pattern 60A and 70A for determining the relative shift between a first and second layer of the substrate in the first and second directions, respectively (Figure 2).

Regarding claim 19, Bareket (6,462,818) discloses the first layer is disposed directly above or below the second layer (Col. 2, lines 8-15).

Regarding claim 20, the arguments analogous to those presented above for claims 1, 4, and 9 are applicable to claim 20. Bareket (6,462,818) further discloses the periodic structure of coarsely segmented elements positioned in the working zones of the first set, 40B and 40C, and the second set, 50B and 50C, are oriented in a first direction, Y-direction, and the second set of working zones is positioned crosswise relative to the first set of working zones (Figure 2).

Regarding claims 23, 26, and 27, the arguments analogous to those presented above for claims 7, 11, and 12 are applicable to claims 23, 26, and 27, respectively.

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8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

9. Claims 31-33 are rejected under 35 U.S.C. 102(b) as being anticipated by Bareket (EP 0818814).

Regarding claim 31, Bareket (EP 0818814) discloses capturing an image of an overlay mark formed on the substrate (Figure 2; Col. 5, lines 33-54), the overlay mark having a plurality of working zones each of the working zones including a periodic structure of coarsely segmented elements (Figure 1b), selecting a plurality of working zones from the captured image, wherein at least one working zone from each layer is selected (Col. 2, lines 1-16; Col. 4, lines 35-57) forming representative signals for each of the selected working zones, wherein at least one signal for each layer is formed (Col. 8, lines 7-58, Col. 9, lines 1-7), and comparing the signal from a first layer to a signal from a second layer to determine the relative shift between different layers (Abstract; Col. 9, lines 18-58, Col. 10, lines 1-79).

Regarding claim 32, Bareket (EP 0818814) discloses forming representative signals by collapsing 2D images of the working zones into 1D signals by averaging over X for Y-overlay calculations and by averaging over Y for X-overlay calculations (Col. 9, lines 34-58, Col. 10, lines 1-19).

Regarding claim 33, Bareket (EP 0818814) discloses comparing the signal from a first layer to a signal from a second layer to determine the relative shift between different layers via a cross correlation, or covariance-based, overlay algorithm (Col. 9, lines 34-56).

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bareket (EP 0818814).

Regarding claim 34, Bareket (EP 0818814) discloses comparing the signal from a first layer to a signal from a second layer to determine the relative shift between different layers via a cross correlation, or covariance-based, overlay algorithm (Col. 9, lines 34-56). Bareket (EP 0818814) further discloses that it is also known to use a Fourier Decomposition overlay algorithm (Col. 9, lines 34-56). At the time of the invention, it would have been obvious to a person of ordinary skill in the art to compare the signals using a Fourier Decomposition overlay algorithm. Applicant has not disclosed that using a Fourier Decomposition overlay algorithm provides an advantage, is used for a particular purpose, or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well with either overlay algorithm because both overlay algorithms perform the same function of comparing two signals to determine the relative shift between the different layers. Therefore, it would have been obvious to one of ordinary skill in the art to modify Bareket (EP 0818814) to obtain the invention as specified in claim 34.

12. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bareket (EP 0818814) as applied to claim 31 above, and further in view of Dirksen et al. (5,674,650).

Regarding claim 35, Bareket (EP 0818814) discloses including coarsely segmented elements (Figure 1b), but does not appear to recognize including coarsely segmented elements formed by a plurality of finely segmented elements. However, Dirksen et al. ("Dirksen") discloses providing coarsely segmented elements (Figure 6a) formed by a plurality of finely segmented elements (Figure 6c). Bareket (EP 0818814) and Dirksen are combinable because they are from a similar problem solving area of measuring alignment. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the coarsely segmented elements disclosed by Bareket (EP 0818814) to include being formed by a plurality of finely segmented elements. The motivation for doing so would have been to increase the accuracy and the reliability of the system by providing smaller measurement marks. Therefore, it would have been obvious to combine Bareket (EP 0818814) with Dirksen to obtain the invention as specified in claim 35.

13. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cresswell et al. (5,617,340) in view of Dirksen et al. (5,674,650).

Regarding claim 30, Cresswell et al. discloses a test region positioned on a first layer of a substrate (Figure 1), the first layer being formed by a first pattern via a first process and a second pattern via second process (Col. 8, lines 12-62), a plurality of working zones positioned in the test region (Figure 1), the working zones representing the actual areas of the test region that are used to determine the relative shift between the first and second patterns (Col. 8, lines 63-67, Col. 9, lines 1-21), wherein a first portion 22, 24, 26 of the working zones are formed via the first

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process and a second portion 28, 30 of the working zones are formed via the second process (Figure 2a-c), and a periodic structure positioned within each of the working zones, each of the periodic structures including a plurality of coarsely segmented elements (Figure 1, Figure 2a-c). Cresswell et al. does not appear to recognize including coarsely segmented elements formed by a plurality of finely segmented elements. However, Dirksen et al. ("Dirksen") discloses providing coarsely segmented elements (Figure 6a) formed by a plurality of finely segmented elements (Figure 6c). Cresswell et al. and Dirksen are combinable because they are from a similar problem solving area of measuring alignment. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the coarsely segmented elements disclosed by Cresswell et al. to include being formed by a plurality of finely segmented elements. The motivation for doing so would have been to increase the accuracy and the reliability of the system by providing smaller measurement marks. Therefore, it would have been obvious to combine Cresswell et al. with Dirksen to obtain the invention as specified in claim 30.

14. Claims 1, 5, 6, 8, 10, 20-22, 24, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaiser (5,172,190) in view of Bareket (EP 0818814).

Regarding claim 1, Kaiser discloses at least one test pattern for determining the relative shift between a first and a second layer in a first direction (Col. 2, lines 1-14), the test pattern having a first set of working zones 2M and 3M (Figure 1) and a second set of working zones 1W and 4W (Figure 2), the first set being disposed on a first layer and having at least two working zones diagonally opposed and spatially offset relative to one another (Figure 1; Col. 1, lines 56-59), the second set being disposed on a second layer and having at least two working zones

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diagonally opposed and spatially offset relative to one another (Figure 2; Col. 1, lines 60-65).

Kaiser discloses the two layers being a mask and a wafer. Kaiser does not appear to disclose successive layers of a substrate. However, Bareket (EP 0818814) discloses determining the relative shift between successive layers of a substrate (Abstract) using a test pattern with a first set of working zones disposed on a first layer 60a and 60b and a second set 70a and 70b being disposed on a second layer (Figure 3; Col. 4, lines 35-57). Kaiser and Bareket (EP 0818814) are combinable because they are from a similar problem solving area of determining an alignment between two objects. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to have modified the layers disclosed by Kaiser to include successive layers of a substrate. The motivation for doing so would have been because it expands the versatility of the system to include determining the alignment of layers of a substrate. Therefore, it would have been obvious to one of ordinary skill in the art to combine Kaiser with Bareket (EP 0818814) to obtain the invention as specified in claim 1.

Regarding claim 5, Kaiser discloses the working zones are positioned within a perimeter of the mark (Figures 1 and 2). Kaiser discloses capturing an image of the areas to be evaluated (Col. 2, lines 1-14). While Kaiser does not expressly state the perimeter of the mark corresponds to the optical perimeter of the field of view of the metrology tool used to image the overlay mark, the field of view defining the area available for capturing an image via the metrology tool, this is a well known methodology routinely implemented in the art. It would have been obvious to one of ordinary skill in the art to specify the size of the mark being imaged corresponds to the field of view of the camera.

Regarding claim 6, Kaiser discloses the working zones substantially fill the perimeter of the mark (Figures 1 and 2).

Regarding claim 8, Kaiser discloses the working zones have identical size and shape (Figures 1 and 2), thereby configured to diminish the impact of non-uniformities across the mark on tool and wafer induced shifts.

Regarding claim 10, Kaiser discloses including a periodic structure positioned within each of the working zones, each of the periodic structures including a plurality of coarsely segmented elements (Figures 1 and 2). Kaiser discloses that different line densities and widths in the alignment marks can be used (Col. 2, lines 66-67, Col. 3, lines 1-2). Kaiser does not appear to disclose the pitch, period, and duty cycle of the coarsely segmented elements are configured to balance the resolution of the metrology used to image the overlay mark and the robustness of the process used to form the layers. However, Bareket (EP 0818814) discloses that the number of lines used is dependent on the resolution required and the signal-to-noise ratio that must be overcome. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to have modified the configuration of the pitch, period, and duty cycle of the coarsely segmented elements disclosed by Kaiser to specify balancing the resolution of the metrology used and the robustness of the process used because it is well known in the art and increases the resulting accuracy of the measurements.

Regarding claim 20, the arguments analogous to those presented above for claim 1 are applicable to claim 20. Kaiser further discloses the periodic structure of coarsely segmented elements positioned in the working zones of the first set, 2M and 3M (Figure 1), and the second

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set, 1W and 4W (Figure 2), are oriented in a first direction, Y-direction, and the second set of working zones is positioned crosswise relative to the first set of working zones (Figures 1 and 2).

Regarding claims 21, 22, 24, and 25, the arguments analogous to those presented above for claims 5, 6, 8, and 10 are applicable to claims 21, 22, 24, and 25, respectively.

15. Claims 13, 14, 28, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kaiser (5,172,190) in view of Bareket (EP 0818814) as applied to claims 1 and 20 above, and further in view of Dirksen et al. (5,674,650).

Regarding claims 13 and 28, Kaiser discloses including a periodic structure positioned within each of the working zones, each of the periodic structures including a plurality of coarsely segmented elements (Figures 1 and 2). Kaiser and Bareket (EP 0818814) do not appear to disclose the plurality of coarsely segmented elements are formed by a plurality of finely segmented elements. However, Dirksen et al. ("Dirksen") discloses providing coarsely segmented elements (Figure 6a) formed by a plurality of finely segmented elements (Figure 6c). Kaiser, Bareket (EP 0818814) and Dirksen are combinable because they are from a similar problem solving area of measuring alignment. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the coarsely segmented elements disclosed by Kaiser and Bareket (EP 0818814) to include being formed by a plurality of finely segmented elements. The motivation for doing so would have been to increase the accuracy and the reliability of the system by providing smaller measurement marks. Therefore, it would have been obvious to combine Kaiser and Bareket (EP 0818814) with Dirksen to obtain the invention as specified in claim 13.


Regarding claims 14 and 29, the arguments analogous to those presented above for claim 13 are applicable to claim 14. Dirksen discloses finely segmented elements configured to provide shift information that more closely matches the relative shift between patterns (Figure 6c).

Contact Information

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Virginia M Kibler whose telephone number is (703) 306-4072. The examiner can normally be reached on Mon-Thurs 8:00 - 5:30 and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (703) 308-6604. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Virginia Kibler
06/17/04

MEHRDAD DASTOURI
PRIMARY EXAMINER

